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Gases and Stoichiometry, Ideal Gas Law, and Worksheet Review:

Complete all work on a separate sheet of paper, use your notes and previous labs to help work through these: ~~Try to~~ Use the problem solving strategies we have modeled in class since the start of the year: hint are provided if you get stuck. Check solutions ~~on class web page or~~ with substitute teacher

1. A gaseous mixture consists of 11.0 g of CO_2 and 48.0 g of O_2. The volume of the container is 22.4 L and the temperature is 273˚C. Calculate the following: ($R = 0.0821$ atm•L mol^{-1}•K^{-1})

(A) The moles of each gas

(B) The mole fraction (X_{gas})of each gas ($X_{gas} = mol_{gas}/ mol_{\ all\ gases}$)

(C) The partial pressure of each gas, (*Hint Apply the Ideal Gas Law to each gas*)

(D) The total pressure of the mixture

2. An 11.2 L container is filled with H_2 at STP. Then 40.0 g of liquid Br_2 is introduced and the mixture is heated to 101˚C. At this temperature, the reaction: $H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$ goes to completion. Calculate the final pressure in the container at 101˚C.

Calculate the moles of each gas and find limiting Reagent.
Mole H_2 =
Mole Br_2 = 40.0 g/159.8 g/mol = 0.25 moles. Br_2 is therefore the limiting reagent.
After the reaction goes to completion:
H_2 = ____ moles,
Br_2 = _____ moles
HBr = _____ moles.
The total moles of gas after the reaction = _____ moles (use this in the final calculation for pressure).

3. When 81.4 mL of H_2 is collected by displacement of water, the water levels inside and outside the gas-collection vessel are equal. This means the pressure of the mixture of gas in the vessel is equal to barometric pressure. The barometric pressure is 740.0 mm Hg and the temperature is 25˚C. Find the moles of H_2 gas in this sample. The vapor pressure of water at 25˚C is 23.76 mm Hg.

Remember that if a gas is collected over water, you have to account for the vapor pressure of water as part of the total pressure of the mixture.

4. The density of a certain gas at 27˚C and 740 mm Hg is 2.53 g/L. Assuming that the gas behaves ideally, calculate its molar mass.

Hint: The Ideal Gas Law can be rewritten in terms of density and molar mass, look in your notes and old labs

5. Calculate the volume of CO_2 produced when 24.0 g of C is completely burned (*combustion reaction with only 1 product*). All measurements are made at 745 mm Hg and 25˚C.

6. A balloon is filled with 0.602 g of H_2 at 35˚C, 1 atm. Calculate:
(A) The volume of the balloon under these conditions

(B) The volume of the balloon if it were tied to a brick and thrown into a pond where, at the bottom, the pressure was 840 mm Hg, and the temperature was 5˚C.

7. A student carries out a reaction, collecting the HCN gas in a 2.0 L container over water, so that the resulting gas is saturated with water vapor at 24˚C. If the mixture exerts a total pressure of 784 mm Hg and the vapor pressure of water at 24˚C is 22.38 mm Hg, determine:

(A) The partial pressure of the HCN gas.

(B) The mass in grams of the HCN collected.

Answers

1.

(A) CO_2 0.250 mol O_2 1.50 mol

(B) the mole fraction of each gas, $X_{CO_2} = 0.143$, $X_{O_2} = 0.857$

(C) O_2 = 1.5atm, CO_2 0.25atm

(D) 1.75 atm.

2. 2.06atm

3. 0.0031mol

4. 64g/mol

5. 49.9L

6.

(A) 7.6L

(B) 6.2L

7.

(A) 761.1mmHg

B) *2.22 grams*